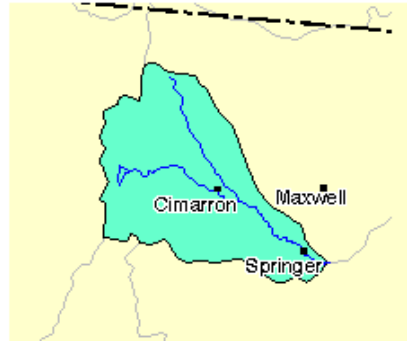
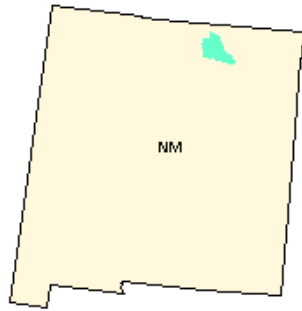


TOTAL MAXIMUM DAILY LOAD FOR TEMPERATURE ON MIDDLE PONIL CREEK



Summary Table

New Mexico Standards Segment	Canadian River , 20.6.4.309
Waterbody Identifier	•Middle Ponil Creek from the confluence with South Ponil Creek to the headwaters, 20.9 mi.
Parameter of Concern	Temperature
Uses Affected	High Quality Coldwater Fishery
Geographic Location	Canadian River Basin (Cimarron)
Scope/size of Watershed	1032 mi ² (entire Cimarron) TMDL reaches: Middle Ponil 72 mi ²
Land Type	Ecoregions: Southern Rockies (210, 211)
Land Use/Cover	Forest (96%), Rangeland (3%), Other< (1%)
Identified Sources	Removal of Riparian Vegetation
Watershed Ownership	Private (58%), Forest Service (30%), State (12%)
Priority Ranking	4
Threatened and Endangered Species	None
TMDL for: Temperature Middle Ponil Creek Upper: Lower:	<p>WLA+ LA+ MOS= 0+ 127.1(joules/meter²/second/day)+ 12.1 (joules/meter²/second/day) = 139.2 (joules/meter²/second/day)</p> <p>WLA+ LA+ MOS= 0+ 120.4(joules/meter²/second/day)+ 14 (joules/meter²/second/day) = 134.4 (joules/meter²/second/day)</p>

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EXECUTIVE SUMMARY

[Section 303\(d\)](#) of the Federal [Clean Water Act](#) requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety (MOS), and natural background conditions.

The Cimarron River Basin is a sub-basin of the Canadian River Basin, located in northeastern New Mexico. Exceedences of New Mexico water quality standards for temperature were documented on Middle Ponil Creek from the confluence with South Ponil Creek to the headwaters (20.9 mi). Thermograph (temperature monitoring devices) were located on Middle Ponil above the confluence with South Ponil Creek (@ Ponil Camp) from 7/17/98-9/23/98, and at an above station Middle Ponil (above Philmont Boy Scout Ranch) from 6/02/99-10/20/99. The thermographs were redeployed at the above station in 1999 to capture a larger time period from June-October, and were placed above the cabins at the Philmont Boy Scout Ranch.

As a result of this monitoring effort, 170/1630 exceedences (approximately 10.4% of the time), of New Mexico water quality standards for temperature were documented in 1998 on Middle Ponil Creek above the confluence with South Ponil Creek, with a maximum temperature of 25.5°C ([Appendix A](#)). At the above station, Middle Ponil (above Philmont Boy Scout Ranch cabins), there were 306/3358 exceedences (approximately 6.3% of the time) in 1999, of New Mexico water quality standards for temperature, with a maximum temperature 24.69°C ([Appendix A](#)). Both these sites exceeded the Temperature Protocol for a one-time maximum temperature (23°C). Calibration and total thermistor error was factored into these temperature readings. This TMDL document addresses these exceedences.

A general implementation plan for activities to be established in the watershed is included in this document. The Surface Water Quality Bureau's [Watershed Protection Section](#) will further develop the details of this plan. Implementation of recommendations in this document will be done with full participation of all interested and affected parties. During implementation, additional water quality data will be collected. As a result targets will be re-examined and potentially revised; this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be removed from the TMDL list.

List of Abbreviations

BMP	Best Management Practice
CFS	Cubic Feet per Second
CWA	Clean Water Act
CWAP	Clean Water Action Plan
EPA	United States Environmental Protection Agency
FS	United States Department of Agriculture Forest Service
HQCWF	High Quality Coldwater Fishery
LA	Load Allocation
MOS	Margin of Safety
MOU	Memorandum of Understanding
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NPS	Nonpoint Source
SNTEMP	Stream Network Temperature Model
SSSOLAR	Solar Shading Model
SSTEMP	Resulting Stream Temperature Model
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
UWA	Unified Watershed Assessment
WLA	Waste Load Allocation
WQLS	Water Quality Limited Segment
WQS	Water Quality Standards
WRAS	Watershed Restoration Action Strategy

Background Information

The Cimarron River Basin is a sub-basin of the Canadian River Basin, located in northeastern New Mexico. This 1032 mi² watershed is dominated by both forest and rangeland ([Figure 1](#)) on mostly private land. In the areas around Middle Ponil Creek, the watershed is dominated by forest and rangeland, mostly on private lands. Middle Ponil Creek (from the confluence with South Ponil Creek to the headwaters, 20.9 miles) flows through the Philmont Boy Scout Ranch with a sub-watershed size of 72 mi².

Surface water quality monitoring stations were used to characterize the water quality of several stream reaches (see [Figure 2](#)). Stations were located to evaluate the impact of tributary streams and to establish background conditions. As a result of monitoring efforts, several exceedances of New Mexico water quality standards for temperature were documented on Middle Ponil Creek. Probable sources of nonsupport include removal of riparian vegetation.

Middle Ponil Creek was evaluated for temperature impairment using temperature criteria in the 2000 [New Mexico Standards](#) for Interstate and Intrastate Surface Waters, the 1999 [Temperature Assessment Protocol](#), the 1999 [Source\(s\) Documentation Protocol](#), and a temperature model Stream Segment Temp (SSTemp). This evaluation was used to determine if a Total Maximum Daily Load (TMDL) should be written for Middle Ponil Creek for temperature.

Endpoint Identification

Target Loading Capacity

The New Mexico Water Quality Control Commission ([WQCC](#)) has adopted numeric water quality standards for temperature to protect the designated use of a high quality coldwater fishery (HQCWF). These water quality standards have been set at a level to protect cold-water aquatic life such as trout. The HQCWF use designation requires that a stream reach must have water quality, stream bed characteristics, and other attributes of habitat sufficient to protect and maintain a propagating coldwater fishery (i.e., a population of reproducing salmonids). The primary standard leading to an assessment of use impairment is the numeric criteria for temperature of 20°C (68°F)¹.

Load Allocations

The Stream Segment and Stream Network Temperature Models²

A temperature model SSTemp was utilized for Middle Ponil Creek to predict stream temperatures based on the stream's geometry, hydrology and meteorology. These values were then compared to actual thermograph readings measured in the field. The SSTemp model closely approximated actual field conditions. The temperature model SSTemp was utilized to identify current stream and/or watershed characteristics that control stream temperatures in Middle Ponil Creek. The model also quantifies the maximum loading capacity of the stream to meet the water quality standard for temperature (maximum of 20°C). This model is important for estimating the effect of changing controls

or factors (such as riparian grazing, stream channel alteration, and reduced streamflow) on stream temperature. The model can also be used to help identify possible implementation activities to improve stream temperature by targeting those factors causing impairment to the stream.

The SSTemp Model utilized Middle Ponil Creek geometry, hydrology, and meteorology to predict minimum 24-hour temperatures, mean 24-hour temperatures, and maximum 24-hour stream temperatures for the hottest times of the year (July-September 1998 and June-September 1999). These values were then compared to actual temperature values taken from the stream (thermograph data).

The maximum daily water temperature is calculated by following a parcel of water from solar noon at the top of the stream segment to the end of the segment, allowing it to heat up towards the maximum equilibrium temperature.

Water temperature can be expressed as heat energy per unit volume. The Stream Segment Temperature Models (SSTEMP) provide an estimate of heat energy per unit volume expressed in Joules (the absolute meter kilogram-second unit of work or energy equal to 10^7 ergs or approximately 0.7375 foot pounds) per meter squared per second ($J/M^2/S$) and Langleys (a unit of solar radiation equivalent to one gram calorie per square centimeter of irradiated surface) per day.

The SSTEMP programs are currently divided into three related but separable components or submodels. Though technically the programs can be run in any order, for our purposes, we will conceptualize them in a physically based order ([Figure 3](#)):

¹ **New Mexico Water Quality Control Commission, State of New Mexico Standards for Interstate and Intrastate Streams (20 NMAC 6.1), Subpart I - General, Section 1102 (I), p. 5, Subpart III - Definitions and Standards Applicable to Attainable or Designated Uses, Section 3101(C), p. 44.**

² **US Geological Survey, Biological Resource Division, Mid-continent Ecological Science Center, River Systems Management Section, Fort Collins, CO, 1997. The Stream Segment and Stream Temperature Models, Version 1.0, pp. 35-50**

Figure 1

Cimarron Watershed - #11080002 Land Use/Cover

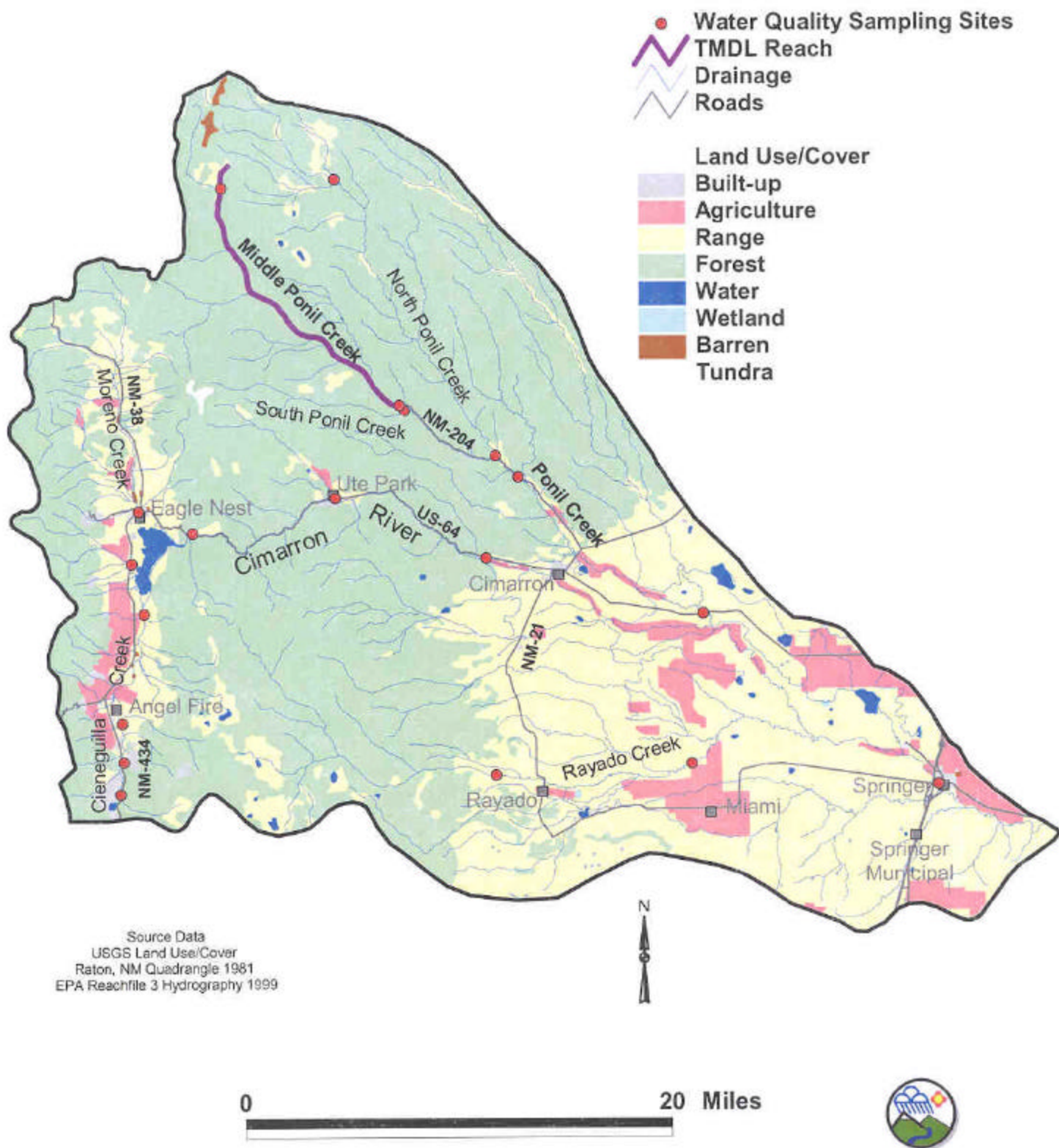


Figure 2 **Cimarron Watershed - #11080002**
Land Ownership

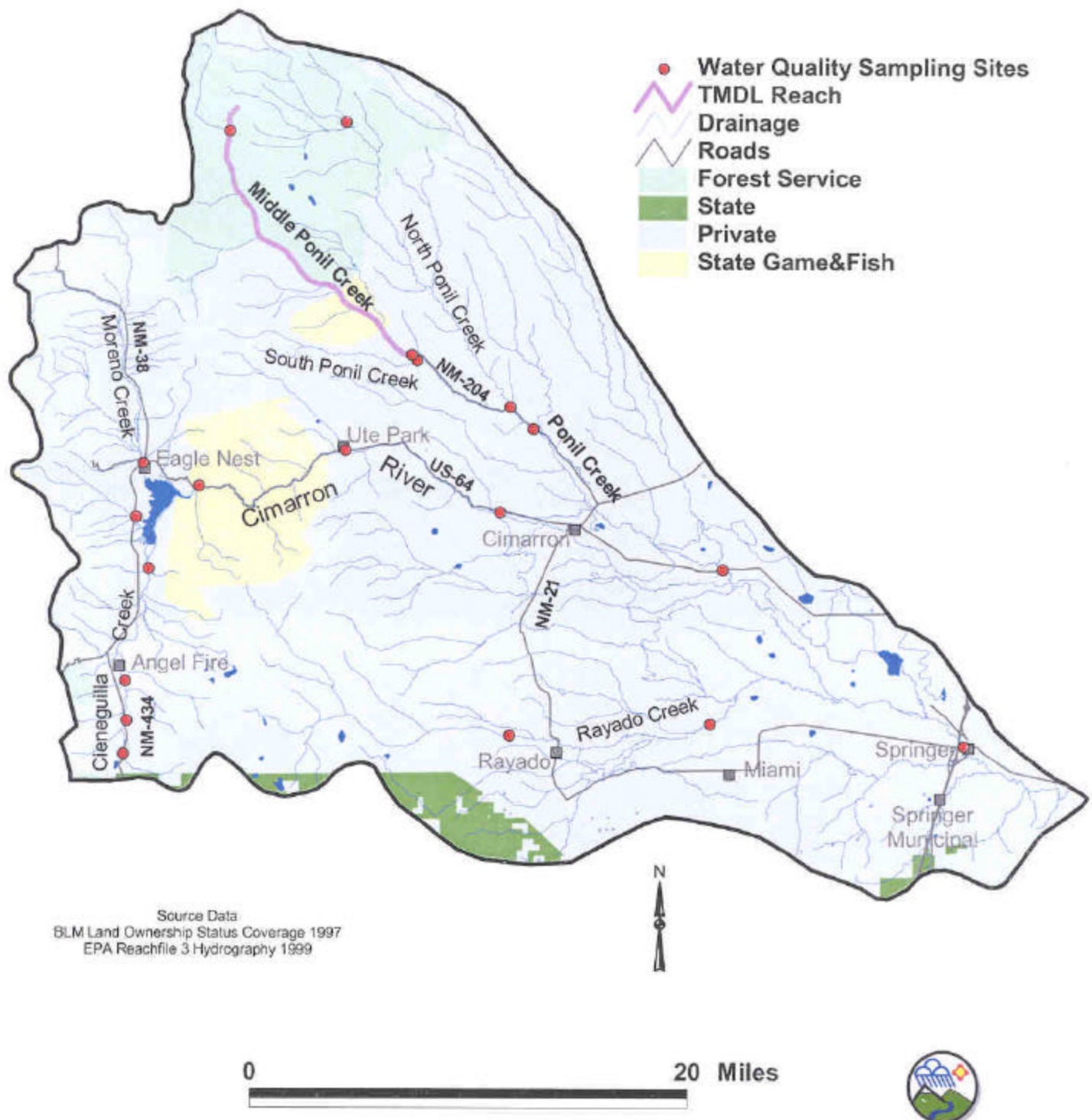
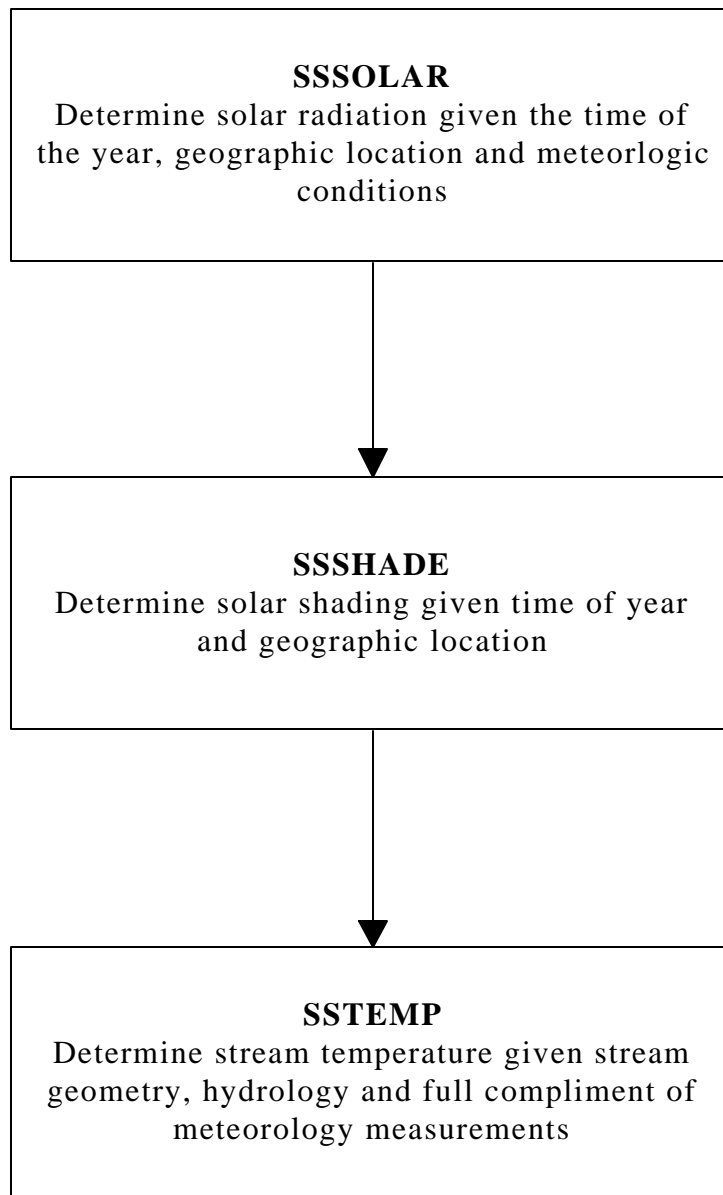


Figure 3. Model Components



Determining the Local Solar Radiation (SSSOLAR)³

To parameterize the model, follow the procedure outlined below:

Beginning Month and Day – Enter the number of the month and day, which start the time period of interest.

Ending Month and Day – Enter the number of the month and day, which end the time period of interest.

Number of Days – The number of days is a factor, which tells the program when and how often to sample during the period. If the results are for a single day only, use one day. For periods between a day and a month, two days is sufficient. Time periods greater than a month are not recommended.

Latitude (degrees and minutes) – Latitude refers to the position of the stream segment on the earth's surface relative to the equator. It may be determined from any standard topographic map. You should enter both degrees and minutes in the spaces provided.

Elevation – Determine mean elevation from the topographic map.

Air Temperature (° F) – Mean daily air temperature representative of the time period modeled.

Relative Humidity (percent) – Mean daily relative humidity representative of the time period modeled.

Possible Sun (percent) – This variable is an indirect measure of cloud cover. Ten percent cloud cover is 90 percent possible sun. Estimates are available from the Weather Service or can be directly measured.

Dust Coefficient – This dimensionless value represents the amount of dust in the air. Representative values are:

Winter	-	6 to 13
Spring	-	5 to 13
Summer	-	3 to 10
Fall	-	4 to 11

If all other variables are known, the dust coefficient may be calibrated by using known ground-level solar radiation data. For the purposes of this model, an intermediate value is sufficient; the model is not very variable sensitive. For example, when modeling summer conditions, entering 6.5 will suffice.

Ground Reflectivity (percent) – The ground reflectivity is a measure of the amount of short wave radiation reflected from the earth back into the atmosphere, and is a function of vegetative cover, snow cover or water. Representative values are:

³ US Geological Survey, Biological Resource Division, Midcontinent Ecological Science Center, River Systems Management Section, Fort Collins, CO, 1997. *The Stream Segment and Stream Temperature Models, Version 1.0*, pp. 37-39

Meadows and fields	14
Leaf and needle forest	5 to 20
Dark, extended mixed forest	4 to 5
Heath	10
Flat ground, grass covered	15 to 33
Flat ground, rock	12 to 15
Flat ground, tilled soil	15 to 30
Sand	10 to 20
Vegetation, early summer	19
Vegetation, late summer	29
Fresh snow	80 to 90
Old snow	60 to 80
Melting snow	40 to 60
Ice	40 to 50
Water	5 to 15

The short wave radiation units are shown in Joules per square meter per second and in Langleys per day. The latter is the common English measurement unit. The values to be carried into SSTEMP are the radiation penetrating the water and the daylight hours.

Determining Solar Shading (SSSHADE)⁴

To parameterize the model, follow the procedure outlined below:

Latitude (degrees and minutes) – Latitude refers to the position of the stream segment on the earth's surface relative to the equator. It may be determined from any standard topographic map. You should enter both degrees and minutes in the spaces provided.

Azimuth (degrees) – Azimuth refers to the general orientation of the stream segment with respect to due South and controls the convention of which side of the stream is east or west. A stream running north-south would have an azimuth of 0°. A stream running northwest-southeast would have an azimuth of –45 degrees. The direction of flow does not matter. Refer to the following diagram for guidance:

Once the azimuth is determined, usually from the topographic map, the east and west sides are fixed by convention.

Width (feet) – Refer to the average width of the stream from water's edge to water's edge for the appropriate time of the year. Note that the width and vegetative offset should usually be changed in tandem.

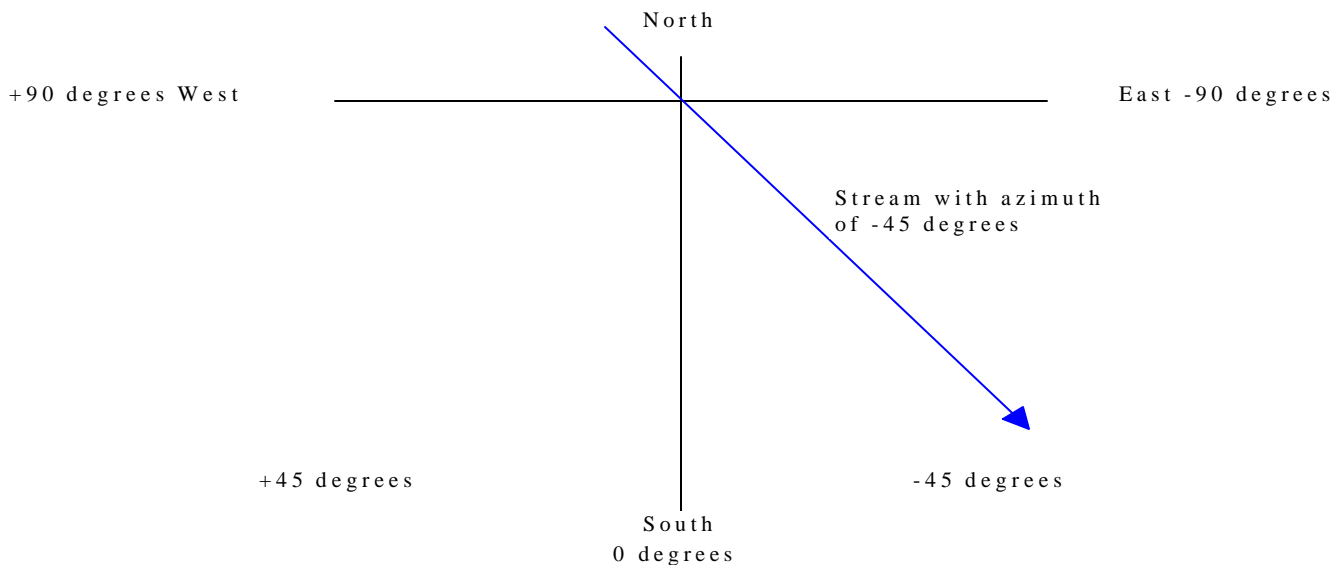
⁴ **US Geological Survey, Biological Resource Division, Midcontinent Ecological Science Center, River Systems Management Section, Fort Collins, CO, 1997. *The Stream Segment and Stream Temperature Models, Version 1.0*, pp. 40-44.**

Month – Enter the number of the month to be modeled.

Day – Enter the number of the day of the month to be modeled. This program's output is for a single day. To compute an average shade value for a longer period (up to one month) use the middle day of that period. The error will usually be less than one percent.

Topographic Altitude (degrees) – This is a measure of the average incline to the horizon from the middle of the stream. Enter a value for both east and west sides. The altitude may be measured with a clinometer or estimated from topographic maps. In hilly country, topographic maps may suffice.

Vegetative Height (feet) – This is the average height for the shade-producing level of vegetation measured from the water's surface.



Vegetation Crown (feet) – This is the average maximum crown diameter for the shade-producing level of vegetation along the stream.

Vegetation Offset (feet) – This is the average offset of the stems of the shade-producing level of vegetation from the water's edge.

Vegetation Density (percent) – This is the average screening factor (0 to 100%) of the shade-producing level of vegetation along the stream. It is composed of two parts: the continuity of the vegetative coverage along the stream (quantity), and the percent of light filtered by the vegetation's leaves and trunks (quality).

For example, if there is vegetation along 25 percent of the stream and the average density of that coverage is 85 percent, the total vegetative density is 0.25 times 0.85, which equals 0.2125, or 21.25 percent. The value should always be between 0 and 100 percent.

To give examples of shade quality, an open pine stand provides about 65 percent light filtering; a closed pine stand provides about 75 percent light removal; relatively dense willow or deciduous stands remove about 85 percent of the light; a tight spruce/fir stand provides about 95 percent light removal. Areas of extensive, dense emergent vegetation should be considered 90 percent efficient for the surface area covered.

The program will predict the total segment shading for the set of variables you provide. The program will also display how much of the total shade is a result of topography and how much is a result of vegetation. The topographic shade and vegetative shade are added to provide total shade. However, one should think of topographic shade as always being dominant in the sense that topography always intercepts radiation first, then the vegetation intercepts what is left. The value for total segment shade is carried forward into the **SSTEMP** program.

Determine Resulting Stream Temperatures (SSTEMP)⁵

To parameterize the model, follow the procedure outlined below:

Segment Inflow (cfs or cms) – Enter the mean daily flow at the top of the stream segment. If the segment begins at a true headwater, the flow may be entered as zero; all accumulated flow will accrue from lateral (groundwater) inflow. If the segment begins at a reservoir, the flow will be outflow from the reservoir. The model assumes steady-state flow conditions.

Inflow Temperature (°F or °C) – Enter the mean daily water temperature at the top of the segment. If the segment begins at a true headwater, you may enter any water temperature because zero flow has zero heat. If there is a reservoir at the inflow, use the reservoir release temperature. Otherwise, use the outflow temperature from the upstream segment.

Segment Outflow (cfs or cms) – The program calculates the lateral discharge by knowing the flow at the head and tail of the segment, subtracting to obtain the net difference, and dividing by segment length. The program assumes that lateral inflow (or outflow) is uniformly apportioned through the length of the segment. If any “major” tributaries enter the segment, divide the segment into subsections between such tributaries. “Major” is defined as any stream contributing greater than 10 percent of the main stem flow.

Lateral Temperature (°F or °C) – The temperature of the lateral inflow, barring tributaries, should be the same as the groundwater temperature. In turn, groundwater temperature is often very close to the mean annual air temperature. This can be verified this by checking US Geological Survey (USGS) well log temperatures. Obvious exceptions may arise in areas of geothermal activity. If irrigation return flows make up most of the lateral flow, they may be warmer than mean annual air temperature.

Return flow temperature may be approximated by equilibrium temperatures.

Segment Length (miles or kilometers) – Enter the length of the segment for which you want to predict the outflow temperature.

Manning’s n (dimensionless) – Manning’s n is an empirical measure of the stream’s “roughness.” A generally acceptable default value is 0.035. The variable is necessary only if you are interested in predicting the minimum and maximum daily fluctuation in temperatures. This variable is not used in the prediction of the mean daily water temperature, and the model is not particularly sensitive to it.

Elevation Upstream (feet or meters) – Enter the elevation as taken from a 7-1/2 minute quadrangle map.

⁵ **US Geological Survey, Biological Resource Division, Midcontinent Ecological Science Center, River Systems Management Section, Fort Collins, CO, 1997. *The Stream Segment and Stream Temperature Models, Version 1.0*, pp. 44-49**

Elevation Downstream (feet or meters) - Enter the elevation as taken from a 7-1/2 minute quadrangle topographic map.

Width's A Term (dimensionless) – *This variable may be derived by calculating the wetted width versus discharge relationship. To conceptualize this, plot the width of the segment on the Y-axis and discharge on the X-axis. Three or more measurements are much better than two. The relationship should approximate a straight line, the slope of which is the B term. Substitution of the stream's actual wetted width for the A term will result if the B term is equal to zero. This is satisfactory if you will not be varying the flow, and thus the stream width, very much in your simulations. If, however, you will be changing the flow by a factor of 10 or so, you should go to the trouble of calculating the A and B terms more precisely.*

Width's B Term (dimensionless) – The B term is calculated by linear measurements from the above mentioned plot. A good estimate in the absence of anything better is 0.20 ([Leopold, 1964](#)).

Thermal Gradient (Joules/Meter²/Second/° C) – This quantity is a measure of the rate of thermal flux from the streambed to the water. The model is not particularly sensitive to this variable. The default value is 1.65.

Air Temperature (° F or ° C) – Enter the mean daily air temperature. This and the following meteorological variables may come from weather reports, which can be obtained for a weather station near the site.

Relative Humidity (percent) – Obtain the mean daily relative humidity for the area by measurement or from the weather service.

Wind Speed (miles/hour or meters/second) – Measure or obtain from the Weather Service.

Percent Possible Sun (percent) – This variable is an indirect measure of cloud cover. Ten percent cloud cover is 90 percent possible sun. Estimates are available from the Weather Service or can be directly measured.

Solar Radiation (Langley's/day or Joules/meter²/second) – Enter the results from the SSSOLAR program. If you use a source other than SSSOLAR (such as [Cinquemani 1978](#)), you should assume that approximately 93 percent of the ground-level solar radiation actually enters the water; the rest is assumed to be reflected. Thus, multiply any recorded ground-level solar measurements by 0.93 to calculate the radiation actually entering the water.

Daylight Length (hours) – Adjust the time between sunrise and sunset for the time of year. You may use the SSSOLAR program to calculate this.

Segment Shading (percent) – This variable refers to how much of the segment is shaded by vegetation, cliffs, etc. If 10 percent of the water surface is shaded, enter 10. To be accurate, the SSSHADE model should be used to predict the actual shading value based on topography, vegetative coverage and vegetative density.

In lieu of using the SSSHADE model, you may think of the shade factor as being the average percent of water surface shaded throughout the day. In actuality, shade represents the percent of the incoming solar radiation that does not reach the water.

Ground Temperature (° F or ° C) – Use mean annual air temperature from the weather service.

Dam at Inflow (Yes = 1 No = 0) – If a reservoir is supplying the inflow, enter a 1, otherwise enter a 0.

The maximum daily water temperature is calculated by following a parcel of water from solar noon at the top of the stream segment to the end of the segment, allowing it to heat up towards the maximum equilibrium temperature. If there is an upstream reservoir or spring that is the source of constant temperature water, and the distance upstream is less than the distance traveled by the water parcel from solar noon to the end of the segment, the water parcel from the dam's discharge is heated instead of the water parcel a full half-day's travel upstream. The stream segment meteorology and geometry supplied as variables will apply to the distance upstream through which the water column travels.

The program will predict the 24-hour minimum, mean and maximum daily water temperature for the set of variables provided. The theoretical basis for the model is strongest for the mean daily temperature.

The maximum daily temperature varies as a function of several different factors.

The mean daily equilibrium temperature is that temperature which the mean daily water temperature will approach if all conditions remain the same as the water parcel travels downstream. Of course, all conditions cannot remain the same, since the elevation changes immediately.

The maximum daily equilibrium temperature is that temperature which the maximum daily water temperature will approach.

Other results include the intermediate variables average width, average depth and slope, calculated from the twenty input variables, and the heat flux components. These heat flux components are abbreviated in the program's output as follows:

ATM	=	atmospheric component
CVN	=	convection component
CDN	=	conduction component
EVP	=	evaporation component
FRC	=	friction component
SOL	=	solar radiation component
VEG	=	vegetative radiation component
WAT	=	water's back radiation component

Assumptions and Limitations⁶

There are several assumptions that apply to SSTEMP. These assumptions in turn dictate the limitations in terms of model applications.

First, SSTEMP is a steady state model. It assumes that the conditions being simulated involve only steady flow – no hydropeaking can be simulated unless the flows are essentially constant for the entire averaging period. The minimum average period is one day. Similarly, the boundary conditions of

⁶ US Geological Survey, Biological Resource Division, Midcontinent Ecological Science Center, River Systems Management Section, Fort Collins, CO, 1997. *The Stream Segment and Stream Temperature Models, Version 1.0*, pp. 26-27

SSTEMP are assumed homogeneous and constant. This has implications for the maximum size of the network simulated for a single averaging period.

Second, SSTEMP assumes homogeneous and instantaneous mixing wherever two sources of water are combined. There is no lateral or vertical temperature distribution (or dispersion/diffusion), represented in the model.

Third, SSTEMP itself is meant solely for stream temperature predictions. It will not handle stratified reservoirs, though river-run reservoirs with equilibrium releases may be simulated.

Fourth, SSTEMP is not a hydrology model. It should be relied on to distribute flows in an ungaged network. That is often an additional, non-temperature model task.

Fifth, SSTEMP may not be reliable in very cold conditions, i.e., water temperatures less than 4°C. It is not meant for ice or the like.

Finally, SSTEMP has been tested only in the northern hemisphere.

Temperature Allocations as Determined by Percent (%) Shade

The following tables show outputs of the three-month model run from June 2 through September 31 for the upstream station (Middle Ponil above Philmont Boy Scout Ranch) and July 17 through September 17 for the downstream station (Middle Ponil Creek above the confluence with South Ponil Creek). As the percent total shade is increased, the maximum 24-hour temperature decreases until the HQCWF standard (20°C, 68°F) is achieved.

On the upper Middle Ponil Creek station, the standard is achieved when the percent total shade of the model is 54% and higher. The actual load **allocation (LA) of 127.1** joules/meter²/second is achieved at 58% shade or higher according to the model runs.

On the lower Middle Ponil Creek station, the standard is achieved when the percent total shade of the model is 52% and higher. The actual load **allocation (LA) of 120.4** joules/meter²/second is achieved at 57 percent shade or higher according to the model runs.

Rosgen Channel Class	WQS (HQCWF)	Model Run Dates	Segment Length (mi)	Solar Radiation Component per 24-Hours (+ /-)	% Total Shade	% Topo Shade	% Veg Shade	Temperature F (24 hour)	Temperature C (24 hour)
B4 Stream Type	20C (68F)	June 2 thru Sept 31	20.9	Current Field Condition 226.9 joules/meter ² /second	25	25	1	Minimum 54.68 Mean 64.58 Maximum 74.48	Minimum 12.6 Mean 18.1 Maximum 23.6
<p>Stream Segment Temperature Model (SSTEMP)</p> <p>TEMPERATURE ALLOCATIONS AS DETERMINED BY % SHADE ON MIDDLE PONIL CREEK ABOVE PHILMONT BOY SCOUT RANCH</p> <p>* DENOTES 24 HOUR ACHIEVEMENT OF SURFACE WATER QUALITY STANDARD FOR TEMPERATURE</p> <p>Actual Reduction in Solar Load to this Stream to meet the State surface water quality standard is:</p> <p>226.9 joules/meter²/second (current condition) – 127.1 joules/meter²/second (58% shaded water) = 99.8 . joules/meter²/second</p> <p>♦ Denotes the achievement of the .127.1 joules/meter²/sec. load allocation (LA)</p>				*139.2 joules/meter ² /second	54	25	29	Minimum 53.09 Mean 60.54 Maximum 67.98	Minimum 11.72 Mean 15.86 Maximum 19.98
				♦ 127.1 joules/meter ² /second	58	25	33	Minimum 52.89 Mean 59.95 Maximum 67.01	Minimum 11.61 Mean 15.53 Maximum 19.45

Three Month Summer Model Run On Middle Ponil Creek above Philmont Boy Scout Ranch

Rosgen Channel Class	WQS (HQCWF)	Model Run Dates	Segment Length (mi)	Solar Radiation Component per 24-Hours (+ /-)	% Total Shade	% Topo Shade	% Veg Shade	Temperature F (24 hour)	Temperature C (24 hour)
B4 Stream Type	20C (68F)	July 1 7 thru Sept 23	20.9	Current Field Condition 210 joules/meter ² /second	25	25	1	Minimum 53.05 Mean 63.41 Maximum 73.76	Minimum 11.69 Mean 17.45 Maximum 23.2
<p>Stream Segment Temperature Model (SSTEMP)</p> <p>TEMPERATURE ALLOCATIONS AS DETERMINED BY % SHADE ON MIDDLE PONIL CREEK ABOVE THE CONFLUENCE WITH SOUTH PONIL CREEK</p> <p>* DENOTES 24 HOUR ACHIEVEMENT OF SURFACE WATER QUALITY STANDARD FOR TEMPERATURE</p> <p>Actual Reduction in Solar Load to this Stream to meet the State surface water quality standard is:</p> <p>210 joules/meter²/second (current condition) – 120.4 joules/meter²/second (57% shaded water) = 89.60 joules/meter²/second</p> <p>♦ Denotes the achievement of the 120.4 joules/meter²/second load allocation (LA)</p>				*134.4 joules/meter ² /second	52	25	27	Minimum 52.01 Mean 59.94 Maximum 67.87	Minimum 11.12 Mean 15.52 Maximum 19.93
				♦ 120.4 joules/meter ² /second	57	25	32	Minimum 51.86 Mean 59.27 Maximum 66.69	Minimum 11.03 Mean 15.15 Maximum 19.27

Two Month Summer Model Run On Middle Ponil Creek above the confluence with South Ponil

Linkage of Water Quality and Pollutant Sources

Where available data are incomplete or where the level of uncertainty in the characterization of sources is large, the recommended approach to TMDLs requires the development of allocations based on estimates utilizing the best available information.

SWQB fieldwork includes an assessment of the potential sources of impairment ([SWQB/NMED 1999a](#)). The Pollutant Source(s) Documentation Protocol, shown as [Appendix C](#), provides an approach for a visual analysis of a pollutant source along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed.

The primary source of impairment along this reach is removal of riparian vegetation. Just above the confluence between Middle Ponil Creek and South Ponil Creek is a road crossing that is used by both animals and vehicles. Along the creek are various animal holding areas and animals graze with full access to the stream. The land surrounding this creek is primarily privately owned, and there are also Forest Service and State Game and Fish lands.

Decreased effective shade levels result from reduction of riparian vegetation. This leads to increased incident solar radiation on the water surface and therefore increased energy loading. Wider stream channels also increase the stream surface area exposed to sunlight and heat transfer. Riparian area and channel morphology disturbances are attributed to past, and to some extent current, rangeland grazing practices, which have resulted in reduction of riparian vegetation and streambank destabilization. These nonpoint sources of pollution primarily affect the water quality parameter temperature through increased solar loading by: (1) increasing stream surface solar radiation and loading and (2) increasing stream surface area exposed to solar radiation loading ([Figure 4](#)).

Riparian vegetation, stream morphology, hydrology, climate and geographic location and aspect influence stream temperature.

Although climate and geographic location and aspect are outside of human control, the condition of the riparian area, channel morphology and hydrology can be affected by land use activities.

Specifically, the elevated summertime stream temperatures attributable to anthropogenic causes in the Cimarron River Basin result from the following conditions:

1. Channel widening (increased width to depth ratios) increases the stream surface area exposed to incident solar radiation,
2. Riparian vegetation disturbance reduces stream surface shading, riparian vegetation height and density,
3. Reduced summertime base flows. Base flows are maintained with a functioning riparian system so that loss of riparian vegetation will

lower and sometimes eliminate base flows.

Analyses presented in this TMDL will demonstrate that defined loading capacities will ensure attainment of State water quality standards.

Specifically, the relationship between shade, solar radiation, and water quality attainment will be demonstrated. Vegetation density increases will provide necessary shading, as well as encourage bank-building processes in severe hydrologic events.

Margin of Safety (MOS)

TMDLs should reflect a margin of safety based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For this TMDL, there will be no margin of safety for point sources, since there are none.

A MOS may be expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions or effectiveness of proposed management actions).

The MOS may be implicit, utilizing conservative assumptions for calculation of the loading capacity, WLAs and LAs. The MOS may also be explicitly stated as an added separate quantity in the TMDL calculation.

In the development of this temperature TMDL, the following conservative assumptions were used to parameterize the model:

- Warmest time of the year was used in the modeling due to the seasonality of temperature exceedences (June 2 through September 31).

The average 1998 monthly ambient air temperatures for June, July and August.

Actual elevation and latitude/longitude were determined by using a global positioning system (GPS) at the site.

- Low flow (4Q3) for Middle Ponil Creek was estimated using the USGS publication “Analysis of the magnitude and frequency of the 4-day, 3-year low-flow discharge and regional low-flow frequency analysis for unregulated streams in New Mexico”, by Scott Waltemeyer (NM500)
- Stream channel geomorphology was used to determine the level of functionality of the stream along with other physical field measurements that were used in the modeling process.

Actual wetted-width of the stream was used.

Actual stream channel type was characterized as a “B” channel.

- Response of receiving waters under various allocation scenarios.

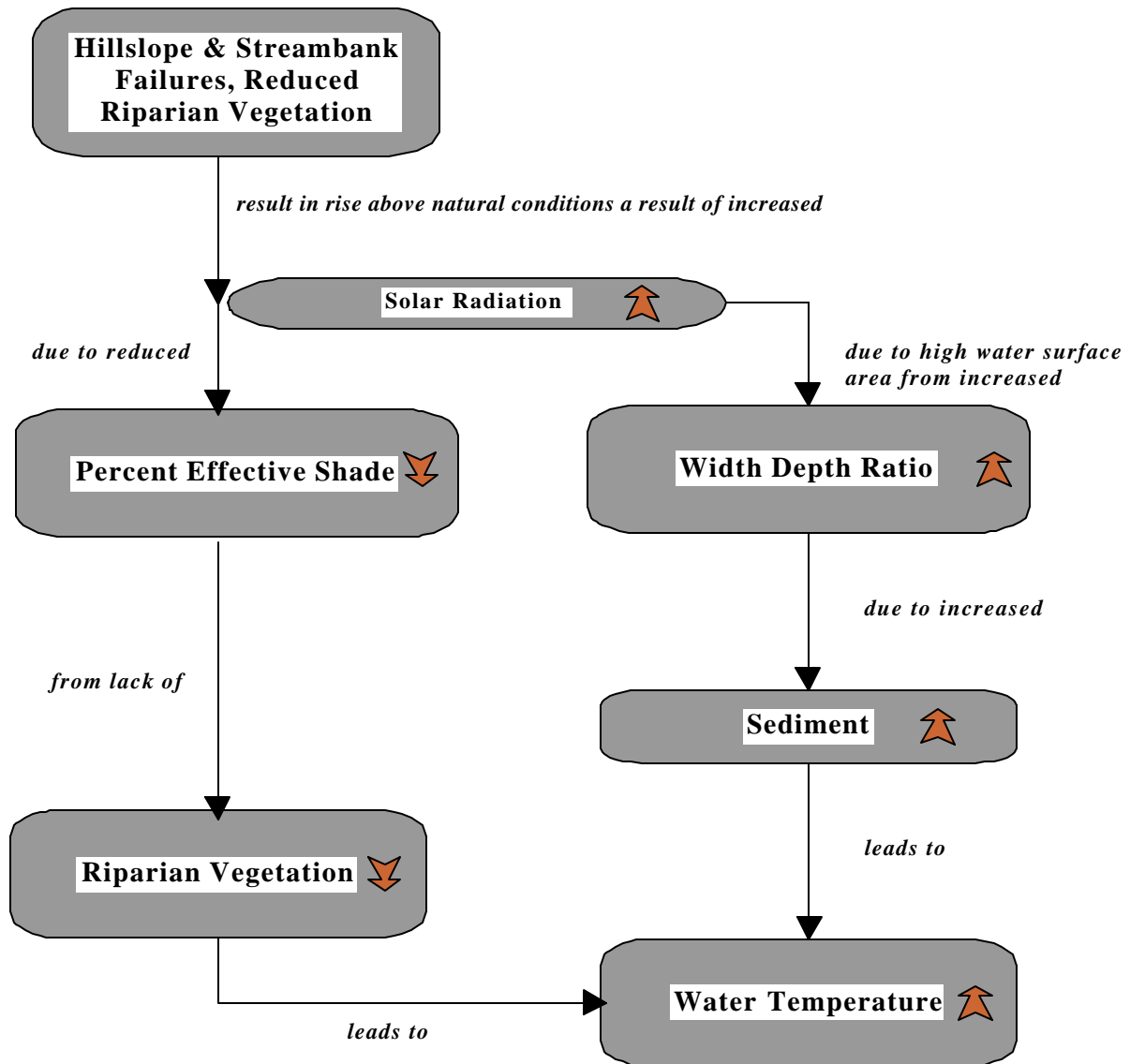
Different shading scenarios were used to show the decrease in water temperatures at critical low flow (see table).

- Expression of analysis results in ranges.

Analysis results provide a range of temperature outputs (see table).

Because of the high quality of data and information that was put into this model and the continuous field monitoring data used to verify these model outputs, an explicit MOS of 10 percent is assigned to this TMDL.

Figure 4. Factors that Impact Water Temperature



Consideration of Seasonal Variation

Section 303(d)(1) of the CWA requires TMDLs to be established at a level necessary to implement the applicable water quality standard with seasonal variation”. Both stream temperature and flow vary seasonally and from year to year. Water temperatures are coolest in winter and early spring months.

Thermograph records show that temperatures exceed State water quality standards in summer and early fall on Middle Ponil Creek. Warmest stream temperatures corresponded to prolonged solar radiation exposure, warm air temperature and low flow conditions. These conditions occur during late summer and early fall and promote the warmest seasonal instream temperatures.

Future Growth

Estimations of future growth are not anticipated to lead to a significant increase for temperature that cannot be controlled with best management practice (BMP) implementation in this watershed. Middle Ponil Creek runs through State land, private lands, and Federally managed lands.

Monitoring Plan

Pursuant to [Section 106\(e\)\(1\)](#) of the Federal [Clean Water Act](#), the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico [Water Quality Act](#), the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State. The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of every five years.

The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document, “Quality Assurance Project Plan for Water Quality Management Programs” (QAPP) is updated annually ([SWQB/NMED 1999b](#)). Current priorities for monitoring in the SWQB are driven by the [303\(d\) list](#) of streams requiring TMDLs. Short-term efforts will be directed toward those waters which are on the EPA TMDL [consent decree](#) (Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997) list and which are due within the first two years of the monitoring schedule. Once assessment

monitoring is completed those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority water bodies, including biological assessments, and compliance monitoring of industrial, federal and municipal dischargers, and are specified in the SWQB Assessment Protocol ([SWQB/NMED 1998](#)).

Long term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited every five years. This gives an unbiased assessment of the waterbody and establishes a long term monitoring record for simple trend analyses. This information will provide time relevant information for use in 305(b) assessments and to support the need for developing TMDLs.

The approach provides:

- o a systematic, detailed review of water quality data, allowing for a more efficient use of valuable monitoring resources.
- o information at a scale where implementation of corrective activities is feasible.
- o an established order of rotation and predictable sampling in each basin, which allows for enhanced coordinated efforts with other programs.
- o program efficiency and improvements in the basis for management decisions.

It should be noted that a basin will not be ignored during its four year sampling hiatus. The rotating basin program will be supplemented with other data collection efforts. Data will be analyzed, field studies will be conducted, to further characterize identified problems, and TMDLs will be developed and implemented. Both long term and field studies can contribute to the [305\(b\) report](#) and 303(d) listing processes.

The following schedule is a draft for the sampling seasons through 2002 and will be followed in a consistent manner to support the New Mexico [Unified Watershed Assessment](#) (UWA) and the [Nonpoint Source Management \(NPS\) Program](#). This sampling regime allows characterization of seasonal variation through sampling in spring, summer, and fall for each of the watersheds.

1998 - Jemez, Chama (above El Vado), Cimarron (above Springer), Santa Fe, San Francisco

1999 - Chama (below El Vado), middle Rio Grande, Gila, Red River

2000 - Dry Cimarron, upper Rio Grande (part1)

2001 - Upper Rio Grande (part 2), upper Pecos (headwaters to Ft. Sumner), lower Pecos (Roswell south)

2002 - Mimbres, Closed Basins, Zuni, Canadian Basin, lower Rio Grande, San Juan, Rio Puerco

Implementation Plan

Management Measures

Management measures are “economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives”(USEPA, 1993). A combination of best management practices (BMPs) will be used to implement this TMDL.

Introduction

Water temperature influences the metabolism, behavior, and mortality of fish and other aquatic organisms that affect fish. Natural temperatures of a waterbody fluctuate daily and seasonally. These natural fluctuations do not eliminate indigenous populations, but may affect existing community structure and geographical distribution of species. Anthropogenic impacts can lead to modifications of these natural temperature cycles, often leading to deleterious impacts on the fishery.

The following are examples of sources that can cause temperature exceedances:

- Lack of shading caused by removal of riparian vegetation,
- Streambank destabilization,
- Reduced base flows caused by such activities as removal of riparian vegetation and manipulation of flows by dams,
- Excessive turbidity, and
- Alterations in stream geomorphology. This can occur when the natural scouring process leads to degradation, or excessive sediment deposition results in aggradation. Both of these processes can lead to a high width/depth ratio (wider, shallower streams)

Actions to be Taken

For this watershed the primary focus will be on the control of temperature.

During the TMDL process in this watershed, point sources have been reviewed and will be addressed through the permit process. The nonpoint source contributions will need to address temperature exceedances through BMP implementation.

There are a number of BMPs that can be utilized to address temperature, depending on the source of the problem. Such BMPs include:

1. The planting of woody riparian species applicable to the affected area provides canopy cover and shading for temperature control and helps prevent streambank destabilization. The woody vegetation provides structure to the bank and reduces stream velocities thereby preventing

excessive streambank erosion. (A Streambank Stabilization and Management Guide for Pennsylvania Landowners, 1986, State of Pennsylvania);

2. River restoration involving such actions as reconfiguration of the river's sinuosity, installation of root wads to stabilize cut banks, and riparian plantings aid in halting bank erosion and the processes of degradation and aggradation and facilitate the return of the river to a natural and stable morphology which incorporates a lower width to depth ratio. This lowered ratio means that the stream has become narrower and deeper. Thus, the stream can maintain cooler temperatures with the increased channel depth and reduced water surface exposed to solar radiation. (A Geomorphological Approach to Restoration of Incised Rivers, 1997, Rosgen, David);
3. The relocation of recreation sites out of riparian areas as well as the closure and rehabilitation of former recreation sites located in riparian areas will help restore riparian vegetation for shading and will eliminate a source of sediment, (Stream Corridor Restoration – Principles, Processes, and Practices, 1998, The Federal Interagency Stream Restoration Working Group).

Additional sources of information for possible BMPs to address temperature are listed below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St Francis Drive, Santa Fe New Mexico.

Agriculture

- Internet websites:
 - www.nm.nrcs.usda.gov
 - Bureau of Land Management, 1990, Cows, Creeks, and Cooperation: Three Colorado Success Stories. Colorado State Office.
 - Cotton, Scott E. and Ann Cotton, Wyoming CRM: Enhancing our Environment.
 - Goodloe, Sid and Susan Alexander, Watershed Restoration through Integrated Resource Management on Public and Private Rangelands.
 - Grazing in New Mexico and the Rio Puerco Valley Bibliography.
- USEPA and The Northwest Resource Information Center, Inc., 1990, Livestock Grazing on Western Riparian Areas.
- USEPA and The Northwest Resource Information Center, Inc., 1993, Managing Change: Livestock Grazing on Western Riparian Areas.

Forestry

- New Mexico Natural Resources Department, 1983, Water Quality Protection Guidelines for Forestry Operations in New Mexico.
 - New Mexico Department of Natural Resources, 1980, New Mexico Forest Practice Guidelines. Forestry Division, Timber Management Section
- State of Alabama. 1993. Alabama's Best Management Practices for Forestry.

Riparian and Streambank Stabilization

- Colorado Department of Natural Resources, Streambank Protection Alternatives. State Soil Conservation Board.
- Meyer, Mary Elizabeth, 1989, A Low Cost Brush Deflection System for Bank Stabilization and Revegetation.
- Missouri Department of Conservation, Restoring Stream Banks With Willows, (pamphlet).
 - New Mexico State University, Revegetating Southwest Riparian Areas, College of Agriculture and Home Economics, Cooperative Extension Service, (pamphlet).
 - State of Pennsylvania, 1986, A Streambank Stabilization And Management Guide for Pennsylvania Landowners. Department of Environmental Resources, Division of Scenic Rivers.
 - State of Tennessee, 1995, Riparian Restoration and Streamside Erosion Control Handbook. Nonpoint Source Water Pollution Management Program.

Roads

- Becker, Burton C. and Thomas Mills, 1972, Guidelines for Erosion and Sediment Control Planning and Implementation, Maryland Department of Water Resources, # R2-72-015.
- Bennett, Francis William, and Roy Donahue, 1975, Methods of Quickly Vegetating Soils of Low Productivity, Construction Activities, US EPA, Office of Water Planning and Standards Report # 440/9-75-006.
- Hopkins, Homer T. and others, Processes, Procedures, and Methods to control Pollution Resulting from all Construction Activity, US EPA Office of Air and Water Programs, EPA Report 430/9-73-007.
- New Mexico Natural Resources Department, 1983, Reducing Erosion from Unpaved Rural Roads in New Mexico, A Guide to Road construction and Maintenance Practices. Soil and Water Conservation Division
- New Mexico State Highway and Transportation Department and USDA-Soil Conservation Service, Roadside Vegetation Management Handbook.
 - New Mexico Environment Department, 1993, Erosion and Sediment Control Manual. Surface Water Quality Bureau.
 - USDA Forest Service Southwestern Region, 1996, Managing Roads for Wet Meadow Ecosystem Recovery. FHWA-FLP-96-016.
 - Section V. New Construction and Reconstruction
 - Section VI. Remedial Treatments**
 - Section VII. Maintenance
 - USEPA, 1992, Rural Roads: Pollution Prevention and Control Measures (handout).

Stormwater

- Delaware Department of Natural Resources and Environmental Control, 1997, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts From Land Development and Achieve Multiple Objectives Related to Land Use. Sediment

and Stormwater Program and The Environment Management Center, Brandywine Conservancy.

- State of Kentucky, 1994, Kentucky Best Management Practices for Construction Activity. Division of Conservation and Division of Water.
 - USEPA, 1992, Storm Water Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices, Summary Guidance, EPA 833-R-92-001, pgs. 7- 9.

Miscellaneous

- Interagency Baer Team, 2000, Cerro Grande Fire Burned Area Emergency Rehabilitation (BAER) Plan, Section F. Specifications.
- New Mexico Environment Department, 2000, A Guide to Successful Watershed Health. Surface Water Quality Bureau.
- Roley, William Jr., Watershed Management and Sediment Control for Ecological Restoration.
- Rosgen, David, 1996, Applied River Morphology, Chapter 8. Applications (Grazing, Fish Habitat).
 - Rosgen, David, 1997, A Geomorphological Approach to Restoration of Incised Rivers.
- The Federal Interagency Stream Restoration Working Group, 1998, Stream Corridor Restoration. Principles, Processes, and Practices.
 - Chapter 8 – Restoration Design
 - Chapter 9 – Restoration implementation, Monitoring, and Management
- USDA Forest Service Southwestern Region, Soil and Water Conservation Practices Handbook.
 - Section 22, Range Management
 - Section 23, Recreation Management
 - Section 24, Timber Management
 - Section 25, Watershed Management
 - Section 26, Wildlife and Fisheries Management
 - Section 41, Access and Transportation Systems and Facilities
- Unknown, Selecting BMPs and other Pollution Control Measures.
- Unknown, Environmental Management. Best Management Practices.
 - Construction Sites
 - Developed Areas
 - Sand and Gravel Pits
 - Farms, Golf Courses, and Lawns

Implementation of this TMDL will consist of three main phases:

1. Temperature baseline verification monitoring
2. BMP implementation
3. Effectiveness monitoring

1. Temperature Baseline Verification Monitoring

Temperature baseline verification monitoring began July 17, 1998 and ran until September 23, 1998 for the lower Middle Ponil site above the confluence with South Ponil Creek. Thermographs were redeployed 1 ½ miles upstream from this site (above Philmont Boy Scout Ranch) from June 2-October 20, 1999. Thermographs were set to read every hour in order to document diurnal fluctuations in the system.

2. Potential Middle Ponil Creek Project BMPs and their Anticipated Contribution to Load Reduction

- 1) Riparian Revegetation (plantings)
Increased canopy cover, stream shade and streambank soil stability. Decreased peak water temperatures, decreased width to depth ratios, a trend toward aggradation of the channel and stream access to the floodplain. Riparian Plantings will consist of native willow, Coyote Willow (*Salix exigua*), Black Willow (*Salix gooddingii*), Narrowleaf Cottonwood (*Populus angustifolia*) and Alder (*Alnus tenuifolia*) plantings or containerized stock.
- 2) Riparian Fencing
Protection for heavily impacted areas and/or newly rehabilitated segments. Increased revegetation success and streambank soil stability. Decreased TSS and turbidity.
- 3) Streambank Modification/Channel Reconstruction
Accelerated healing of banks, restoration of sinuosity patterns, reduced erosion and sedimentation originating from raw streambanks.

This project on Middle Ponil Creek will potentially result in approximately 20.9 linear miles of revegetation. Final priorities concerning riparian fencing, streambank/channel modification will be made now that baseline verification monitoring has been completed. SWQB will encourage public/private land owners and volunteers to become involved and assist in all phases of the implementation process.

3. BMP Effectiveness Monitoring

The currently approved QAPP and Nonpoint Source (NPS) Standard Operating Procedures (SOP) methods will be used for all sampling and monitoring for this project. In order to estimate BMP effectiveness, monitoring efforts will focus on the appropriate physical components of the stream system.

The following physical parameters will be monitored in order to evaluate the effectiveness of BMP's:

- Cross Channel Profiles
 - These profiles will be established in key locations to measure changes in channel morphology and width:depth ratios. Natural stream channel stability is achieved by allowing the river to develop a stable dimension, pattern and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades.
- Riparian Canopy Densities
 - Density will be measured at fixed locations to determine quantifiable differences in stream shade.
- Photo Documentation Points
 - Photographs will be used to evaluate the success of revegetation efforts and to document changes in channel morphology.

It is recognized that measurable changes in these parameters will require some time occur. Accordingly, monitoring activities will continue until changes in the temperature of Middle Ponil Creek have demonstrated the effectiveness of the BMPs.

Other BMP Activities in the Watershed

The following are activities in this watershed that have occurred, are occurring, or are in the planning stages to address turbidity sources or other nonpoint source issues in the Ponil watershed (which includes Ponil and Middle Ponil Creeks).

The Carson National Forest has been and continues to be involved in management activities on lands in the upper reaches of the Ponil watershed. Many of these management activities are undertaken to address issues with sediment, turbidity, and water temperature. The Valle Vidal Unit (Unit), which includes portions of the upper Ponil watershed, was donated to the federal government in 1982 by Penzoil Corporation. Prior to the acquisition of the Unit, the area was managed as a private ranch. Mining, grazing and logging were all historic uses made of the land. Currently, the Valle Vidal is managed with an emphasis focused on recreation, wildlife and fisheries and grazing.

Currently, 865 head of cattle are permitted on the Valle Vidal Unit. Grazing activities within the Middle Ponil Creek are limited to 4-6 days per year as the cattle are herded from the east side to the west side of the Unit. In addition, the Forest Service utilizes a 500 acre pasture located near Shuree Lodge for approximately 2 months each summer for administrative use for 3 to 5 horses.

When the Valle Vidal was acquired approximately 350 miles of roads were in place. These roads supported the historic uses in place prior to acquisition by the Forest Service. Since that time

approximately 300 miles have been closed or obliterated. The remaining road system serves to allow for public access and for administrative use. Vehicular access throughout the Unit is restricted to the road system, and no parking, other than in designated areas or along the roads, is allowed. OHV use is also prohibited.

Recreational developments consist of Cimarron Campground and the Shuree Ponds, which consist of fishing ponds, a trail system and fishing pier, and picnic tables and rest rooms. Dispersed camping is allowed, but campers must remain a minimum of 100 yards from streams and creeks and 300 yards from any man made water development. This requirement, in effect, prohibits dispersed camping from all but the headwaters of the Middle Ponil.

The Carson National Forest is also involved in stream restoration activities in the upper Ponil Watershed. The Ring Place Drainage is an ephemeral stream that was incised and eroded with a moving headcut. A volunteer effort was organized to address the problems on this system, utilizing methods that are affordable and easy to implement developed by Mr. Bill Zeedyk. The headcut was addressed and a series of one-rock dams were placed in the stream each year to capture sediment, raise the streambed, and induce meandering. This has been a very successful project.

The Carson National Forest is planning to utilize similar methodologies on McCrystal Creek this year to stabilize the creek and re-create sinuosity in the system utilizing Mr. Zeedyk's expertise. In addition, other rehabilitation efforts will be implemented on other sections of the river reach that include bank grading and riparian planting.

Lastly, the Carson National Forest has used prescribed burning and timber stand improvements, namely thinning, in the Ponil watershed to reduce fuels and improve watershed conditions and wildlife habitat. These efforts will continue within program priorities and funding levels.

Coordination

In this watershed public awareness and involvement will be crucial to the successful implementation of this plan and improved water quality. Staff from the SWQB will work with stakeholders to provide the guidance in developing the Watershed Restoration Action Strategy (WRAS). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It includes opportunities for private landowners and public agencies in reducing and preventing impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving a reduction of turbidity and will be used to prevent water quality impacts in the watershed. SWQB staff will assist with any technical assistance such as selection and application of BMPs needed to meet WRAS goals.

The SWQB will work with stakeholders in this watershed to encourage the implementation of BMPs such as pinyon and juniper thinning in areas that have had excessive encroachment of these tree and which are an obvious source of surface runoff and gully formation. The SWQB will also work with the Philmont Boy Scout Ranch to determine if BMPs are needed to address potential impacts from

concentrated use by the boy scouts. In addition the SWQB will provide outreach and education to the Philmont Boy Scout Ranch regarding nonpoint source pollution issues and will encourage involvement by the Ranch and boy scouts in volunteer efforts to address water quality issues. The SWQB will encourage other landowners to implement, if applicable, new grazing management to address riparian and watershed issues. Since the induced meandering methodologies developed by Mr. Zeedyk have proven to be successful, landowners in the watershed will be encouraged to view the results of such efforts and use them in similar situations on their lands. Certain reaches in the Ponil watershed may be suitable for the re-introduction of beaver. Beaver have been proven as a very effective and affordable BMP to repair degraded streams systems. Their activities can bring about a rapid regrowth of riparian vegetation, change an ephemeral stream into a perennial stream, capture sediment, raise the water table, and reduce flood velocities. Lastly, the SWQB will encourage all landowners in the watershed to address road issues such as dirt roads that have been constructed without proper drainage controls to prevent sediment from reaching watercourses.

Stakeholders in this process will include SWQB, and other members of the Watershed Restoration Action Strategy such as the Carson National Forest, Vermejo Park, the Philmont Boy Scout Ranch, the Town of Cimarron, the New Mexico State Highway Department, and other private landowners.

Implementation of BMPs within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis. Reductions from point sources will be addressed in revisions to discharge permits.

Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing.

Timeline

The following is an anticipated timeline for TMDL implementation in this watershed.

Implementation Actions	Year 1	Year 2	Year 3	Year 4	Year 5
Public Outreach and Involvement	X	X	X	X	X
Establish Milestones	X				
Secure Funding	X		X		
Implement Management Measures (BMPs)		X	X		
Monitor BMPs		X	X	X	
Determine BMP Effectiveness				X	X
Re-evaluate Milestones				X	X

319(h) Funding Options

The Watershed Protection Section of the SWQB provides USEPA 319(h) funding to assist in implementation of BMPs to address water quality problems on reaches listed on the 303(d) list or which

are located within Category I Watersheds as identified under the Unified Watershed Assessment of the Clean Water Action Plan. These monies are available to all private, for profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, Federal agencies, or agencies of the State. Proposals are submitted by applicants through a Request for Proposals (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services. Further information on funding from the Clean Water Act, Section 319(h) can be found at the New Mexico Environment Department website:

www.nmenv.state.nm.us/swqb/swqb.html.

Assurances

New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution. The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. The Water Quality Act also states in §74-6-12(a):

The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.

In addition, the State of New Mexico Surface Water Quality Standards (see Section 1100E and Section 1105C) (NMWQCC 1995) states:

These water quality standards do not grant the Commission or any other entity the power to create, take away or modify property rights in water.

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water, which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

Nonpoint source water quality improvement work utilizes the voluntary approach. This provides technical support and grant money for the implementation of best management practices and other NPS prevention mechanisms through §319 of the Clean Water Act. Since this TMDL will be implemented through NPS control mechanisms the New Mexico Nonpoint Source Program is targeting efforts to this and other watersheds with TMDLs. The Nonpoint Source Program coordinates with the Nonpoint Source Taskforce. The Nonpoint Source Taskforce is the New Mexico statewide focus group representing federal and state agencies, local governments, tribes and pueblos, soil and water conservation districts, environmental organizations, industry, and the public. This group meets on a quarterly basis to provide input on the Section 319 program process, to disseminate information to other stakeholders and the public regarding nonpoint source issues, to identify complementary programs and sources of funding, and to help review and rank Section 319 proposals.

In order to ensure reasonable assurances for implementation in watersheds with multiple landowners, including Federal, State and private, NMED has established MOUs with several Federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other State agencies, such as the New Mexico Highway Department. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

New Mexico's Clean Water Action Plan has been developed in a coordinated manner with the State's 303(d) process. All Category I watersheds identified in New Mexico's Unified Watershed Assessment process are totally coincident with the impaired waters list for 1996 and 1998 approved by EPA. The State has given a high priority for funding assessment and restoration activities to these watersheds.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. The cooperation of the Carson National Forest, the Vermejo Ranch, the Philmont Boy Scout Ranch, the Town of Cimarron, the New Mexico State Highway and Transportation Department, and other landowners will be pivotal in the implementation of this TMDL.

Milestones

Milestones will be used to determine if control actions are being implemented and standards attained. For this TMDL, several milestones will be established which will vary and will be determined by the BMPs implemented. Examples of milestones for temperature control include:

Education/Outreach Milestone

Implement outreach programs for schools, educators, citizens, government officials, landowners, land managers, resource professionals and agency representatives.

Grazing/Rangeland Milestones

Demonstrate rotational grazing and other grazing/wildlife management systems. Implement projects on federal, State and private lands for riparian restoration with improved grazing/wildlife management.

Agriculture Milestones

Implement erosion control BMPs.

Milestones will be coordinated by SWQB staff and will be re-evaluated periodically, depending on which BMPs were implemented. Further implementation of this TMDL will be revised based on this reevaluation. As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may need to be changed. In the event that new data or information shows that changes are warranted, TMDL revisions will be made with assistance of watershed stakeholders. The re-examination process will involve: monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-

evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

The time required to attain standards in this case is estimated to be approximately 10 years. Standards attainment is predicated on the following growth rates of the riparian species as follows:

<u>Plant Species</u>	<u>Predicted Time to Maturity (years)</u>
Coyote Willow (<i>Salix exigua</i>)	1-3
Black Willow (<i>Salix gooddingii</i>)	1-3
Alder (<i>Alnus tenuifolia</i>)	3-5
Narrowleaf Cottonwood (<i>Populus angustifolia</i>)	7-10

Measures of Success:

- Improved bank stability and vegetation stability by increasing root systems thus decreasing sediment inputs into the system and improving canopy densities. Measurement tools include but are not limited to pebble counts, embeddedness, % fines, canopy densities and root density estimates.
- Increased stream shade. Measurement tool spherical densiometer readings.
- Measurable reductions in TSS and peak turbidity. Measurement tools include but are not limited to pebble counts, embeddedness, % fines, turbidity readings and lab analyses.
- Increased interagency cooperation via communications with the land management agencies, soliciting their input into the process.
- Increased public participation via pre-monitoring and post-monitoring meetings.

An expanded water quality database to foster an understanding of the relationships between traditional management activities and NPS pollution.

- Increased interagency agreement in determining BMP application and suitability.
- Appropriateness of milestones will be re-evaluated periodically, depending on the BMPs that were implemented. Further implementation of this TMDL will be revised based on this re-evaluation.

Public Participation

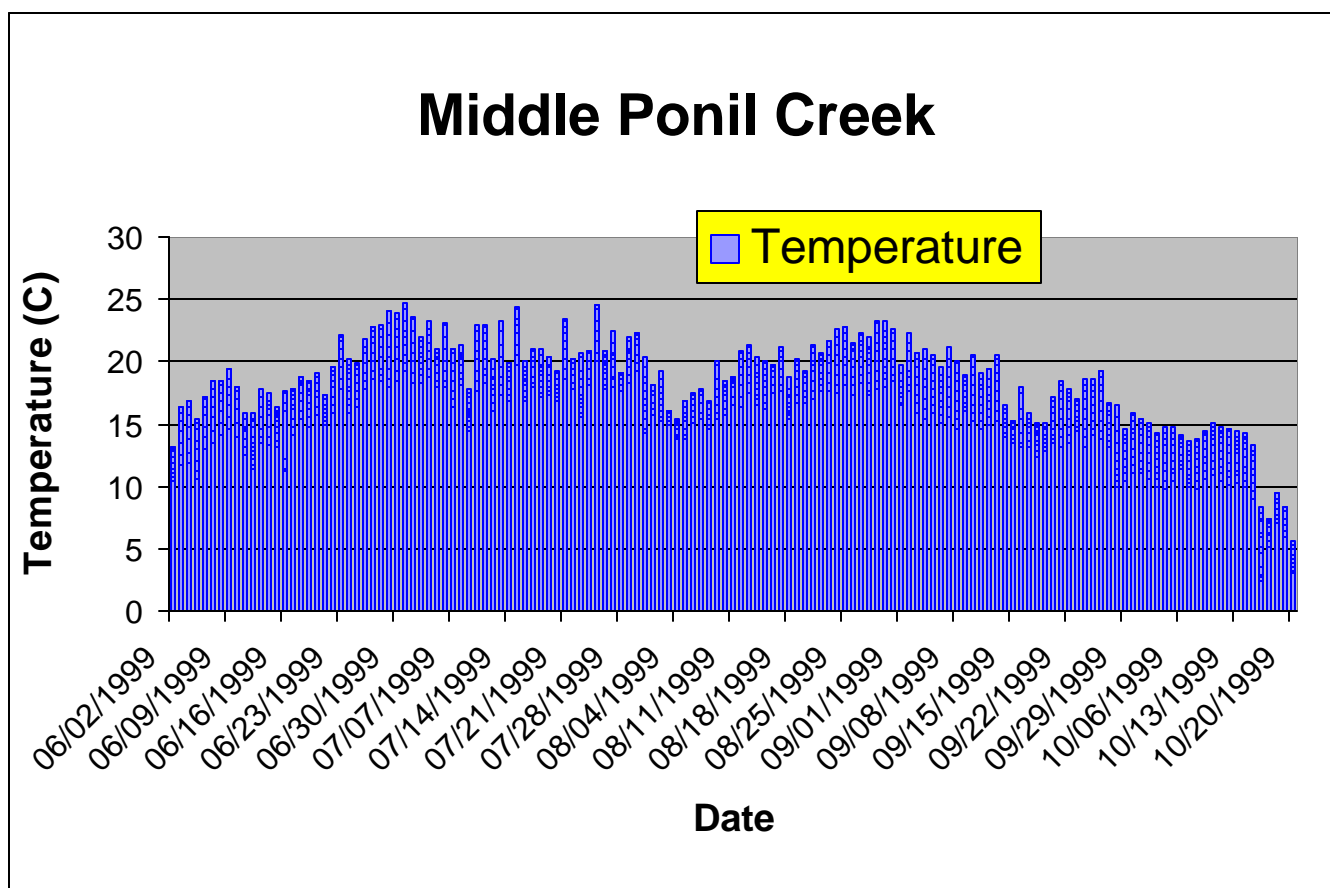
Public participation was solicited in development of these TMDLs. See [Appendix D](#) for flow chart of the public participation process. The draft TMDLs were made available for a 30-day comment period starting **April 10, 2001**. Response to comments is attached as [Appendix E](#) of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (www.nmenv.state.nm.us/swqb/swqb.html) and press releases to area newspapers.

Appendices

Appendix A Thermograph Data and Sites

Middle Ponil Creek above Philmont Boy Scout Ranch Data (upper station)

Total Reading	3358
Max. Temp.	24.69
# Values >20	306
% Values >20	6.3
Avg. Temp.	14.8
Min. Temp.	2.13
Variance	16



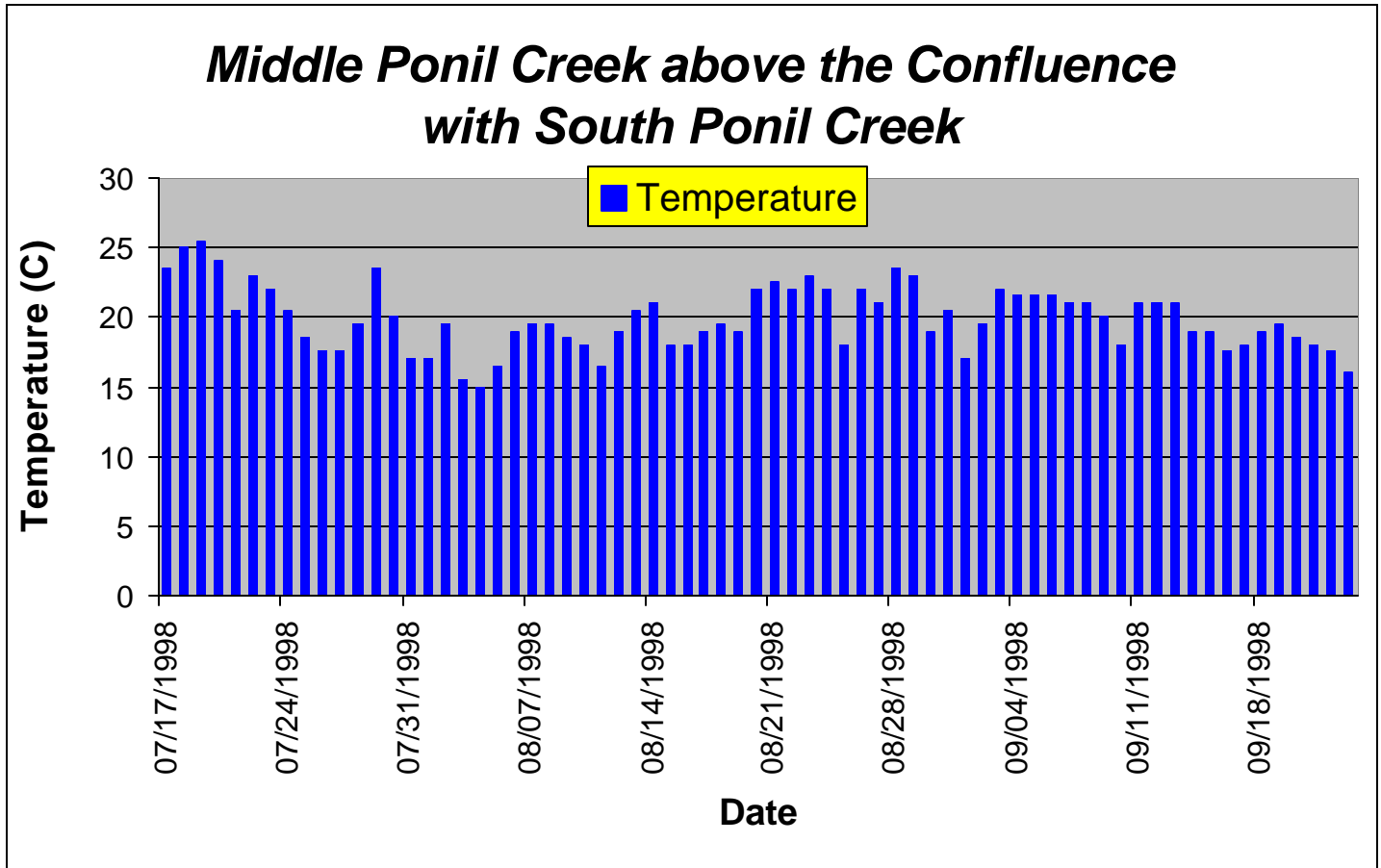
Each bar on the graph represents the 24-hour maximum temperature on each day, not the entire data set of 3358 readings.

Middle Ponil Creek above Philmont Boy Scout Ranch (upper station) Thermograph Site



Middle Ponil Creek above the confluence with South Ponil Creek (lower station)

Total Reading	1630
Max. Temp.	25.5
# Values >20	170
% Values >20	10.4
Avg. Temp.	16.3
Min. Temp.	8
Variance	8.3



Each bar on the graph represents the 24-hour maximum temperature on each day, not the entire data set of 1630 readings.

Middle Ponil Creek above the confluence with South Ponil Creek (lower) Thermograph Site



Appendix B SSTEMP Model Outputs

Middle Ponil Creek above Philmont Boy Scout Ranch (Upper station)

Run #1 (Current Condition)

.468	Segment Inflow	cfs
58.64	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	
0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.3	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
624.85	Solar Radiation	Langley's
13.83	Daylight Length	hr
25	Segment Shading	%
49.7	Ground Temperature	°F
0	Dam at Inflow	no

Minimum 24 hour Temperature 54.68 °F

Mean 24 hour Temperature 64.58 °F

Maximum 24 hour Temperature 74.48 °F

Run #2 (Condition to meet the Standard)

.468	Segment Inflow	cfs
58.64	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	

0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.3	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
624.85	Solar Radiation	Langley's
13.83	Daylight Length	hr
54	Segment Shading	
49.7	Ground Temperature	°F
0	Dam at Inflow	no
Minimum 24 hour Temperature		
		53.09 °F
Mean 24 hour Temperature		
		60.54 °F
Maximum 24 hour Temperature		
		67.98 °F

Run #3 (Load Allocation)

.468	Segment Inflow	cfs
58.64	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	
0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.30	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
624.85	Solar Radiation	Langley's
13.83	Daylight Length	hr
58	Segment Shading	
49.7	Ground Temperature	°F
0	Dam at Inflow	no
Minimum 24 hour Temperature		
		52.89 °F
Mean 24 hour Temperature		
		59.95 °F
Maximum 24 hour Temperature		
		67.01 °F

**Middle Ponil Creek above the confluence with South Ponil Creek
(lower station)**

Run #1 (Current Condition)

.468	Segment Inflow	cfs
61.34	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	
0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
578.11	Solar Radiation	Langley's
13.21	Daylight Length	hr
25	Segment Shading	%
49.7	Ground Temperature	°F
0	Dam at Inflow	no

Minimum 24 hour Temperature	53.05 °F
Mean 24 hour Temperature	63.41 °F
Maximum 24 hour Temperature	73.76 °F

Run #2 (Condition to meet the Standard)

.468	Segment Inflow	cfs
61.34	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	

0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
578.11	Solar Radiation	Langley's
13.21	Daylight Length	hr
52	Segment Shading	
49.7	Ground Temperature	°F
0	Dam at Inflow	no
Minimum 24 hour Temperature		
		52.01 °F
Mean 24 hour Temperature		
		59.94 °F
Maximum 24 hour Temperature		
		67.87 °F

Run #3 (Load Allocation)

.468	Segment Inflow	cfs
61.34	Inflow Temperature	°F
.468	Segment Outflow	cfs
50	Lateral Temperature	°F
20.9	Segment Length	mi
0.081	Manning's n	
11000	Elevation Upstream	ft
7128	Elevation Downstream	ft
9.89	Width's A Term	
0.200	B Term where $W=A*Q*B$	
1.65	Thermal Gradient $j/m^2/s/c$	
65.	Air Temperature	°F
45	Relative Humidity	%
8.3	Wind Speed	mph
78	Percent Possible Sun	%
578.11	Solar Radiation	Langley's
13.21	Daylight Length	hr
57	Segment Shading	
49.7	Ground Temperature	°F
0	Dam at Inflow	no
Minimum 24 hour Temperature		
		51.86 °F
Mean 24 hour Temperature		
		59.27 °F
Maximum 24 hour Temperature		
		66.69 °F

Appendix C: Pollutant Source(s) Documentation Protocol

POLLUTANT SOURCE(S) DOCUMENTATION PROTOCOL

This protocol was designed to support federal regulations and guidance requiring states to document and include probable source(s) of pollutant(s) in their §303(d) lists as well as the States §305(b) Report to Congress.

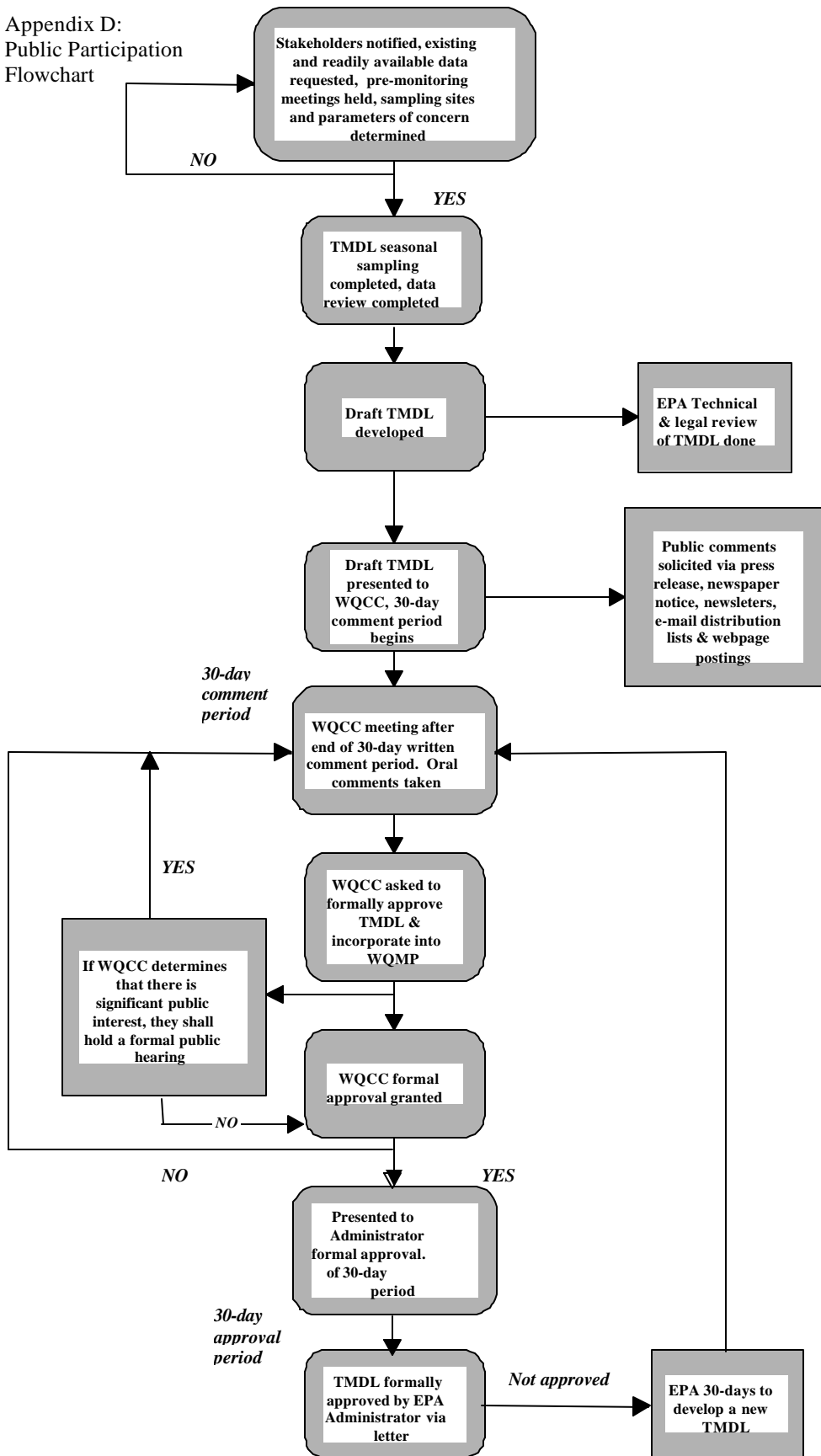
The following procedure should be used when sampling crews are in the field conducting water quality surveys or at any other time field staff are collecting data.

Pollutant Source Documentation Steps:

- 1). Obtain a copy of the most current §303(d) list.
- 2). Obtain copies of the *Field Sheet for Assessing Designated Uses and Nonpoint Sources of Pollution*.
- 3). Obtain 35mm camera that has time/date photo stamp on it. **DO NOT USE A DIGITAL CAMERA FOR THIS PHOTODOCUMENTATION**
- 4). Identify the reach(s) and probable source(s) of pollutant in the §303(d) list associated with the project that you will be working on.
- 5). Verify if current source(s) listed in the §303(d) list are accurate.
- 6). Check the appropriate box(s) on the field sheet for source(s) of nonsupport and estimate percent contribution of each source.
- 7). Photo document probable source(s) of pollutant.
- 8). Create a folder for the TMDL files, insert field sheet and photo documentation into the file.

This information will be used to update §303(d) lists and the States §305(b) Report to Congress.

Appendix D:
Public Participation
Flowchart



STATE OF NEW MEXICO

County of Santa Fe

SS

Bill Tafoya, being duly sworn, declares and says that he is Classified Advertising Manager of The Journal North, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made of assessed as court cost; that the notice, copy of which is hereto attached, was published in said paper in the regular daily edition, for 7 times, the first publication being on the 7 day of April, 2001, and the subsequent consecutive publications on Apr. 9, 2001.

Sworn and subscribed to before me, a Notary Public, in and for the County of Bernalillo and State of New Mexico this 9 day of April, 2001.

PRICE 80.08

Statement to come at end of month.

ACCOUNT NUMBER C83171

CLA-22-A (R-4-97)



OFF
Samantha
NOT
STATE OF

My Commission Expires:

Samantha

NOTICE OF 30-DAY PUBLIC COMMENT PERIOD AND COMMUNITY MEETING FOR DRAFT TOTAL MAXIMUM DAILY LOADS (TMDLs)

THE NEW MEXICO ENVIRONMENT DEPARTMENT, SURFACE WATER QUALITY BUREAU ON THE PROPOSED TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR PONIL AND MIDDLE PONIL CREEKS

The New Mexico Environment Department (NMED), Surface Water Quality Bureau (SWQB) is inviting the public to comment on draft "total maximum daily loads" (TMDLs) for Ponil and Middle Ponil Creeks. Both creeks are located in Colfax County near the Town of Cimarron. The SWQB will hold a community meeting on Wednesday, May 2nd, from 8:30 p.m. to 3:30 p.m. at the Cimarron Village Hall, 356-B East 9th St. to allow public input on the draft TMDLs for the above-mentioned creeks.

A TMDL is a specific, water quality goal and a means for recommending controls needed to meet water quality standards in a particular water or watershed. Establishing a TMDL is an important step in watershed protection because it sets quantified goals for water quality conditions that may then determine what actions are needed to restore or protect the health of the waterbody. Ponil Creek (from the mouth on the Cimarron River to the confluence of North Ponil and South Ponil Creeks, 15.8 miles) has a sub-watershed size of 333 square miles and flows east of the town of Cimarron. Middle Ponil Creek (from the confluence with South Ponil Creek to the headwaters, 20.9 miles) flows through the Philmont Boy Scout Ranch with a sub-watershed size of 72 square miles.

Pollutants of concern for Ponil Creek are those which exceeded the state surface water quality standards. These include metals (specifically, chronic aluminum), temperature and turbidity. Middle Ponil Creek exceeded the state surface water quality standard for temperature and turbidity.

The New Mexico Water Quality Control Commission (NMWQCC) will hold a regular public meeting at 9:00 a.m. on Tuesday, April 10, 2001 at the State Land Office, Morgan Hall, 310 Old Santa Fe Trail, Santa Fe, New Mexico. This meeting will be the start of the 30-day public comment period for the Ponil and Middle Ponil Creek TMDLs. The 30-day public comment period for the Middle Ponil Creek TMDLs and May 8, 2001 at 5:00 p.m. mountain daylight time. Final Ponil and Middle Ponil Creek TMDLs will be submitted to the New Mexico Water Quality Control Commission (NMWQCC) for their formal approval at the scheduled public meeting tentatively set for June 12, 2001 at which time public comments will also be accepted.

For more information, contact David Hogge, in the NMED SWQB, at P.O. Box 26110, Santa Fe, New Mexico 87502 or by calling (505) 827-2861. The draft TMDLs will also be posted in the TMDL Development Section of the Surface Water Quality Bureau's website (by April 10, 2001), which can be found at: www.nmenv.state.nm.us/swqb/swqb.html

Journal North: April 7, 9, 2001

Cimarron Watershed Public Meeting Attendees
(Discussion of Draft TMDLs)
2 May 2001

Name	Affiliation	Mailing Address	Phone/Fax Nos.	E-mail Address
Julia Davis Stafford	OS Ranch	RR 1 Box 62 Cimarron, NM	505) 376-2827 505) 376-2995	
Charles W. Walker	NACS	245 Park Ave Arlton, NM 87740	505-445-9571	
Scott Berry	K.S. Berry Engineering	808 South 2nd St. Raton, NM 87740	505-445-6132	
Thomas Hargett	AVID	RT 1 BOX 44 SPRINGOCK NM 87747	447-9663	
BOB RICKLEFS	PHILMONT	RT 1 Box 35 Cimarron 87747	376 2281 376 2602	
Gregory Sammis PARKER	CHASE RANCH	PO Box 227	505 376 2398 505 376 2105	
Gregory T. Parker		PO Box 360	505 376 2584	PARKER G. CIMARRON. SPRINGER COOP. COM

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ENVIRONMENT DEPARTMENT
ATTN: STEPHANIE STRINGER
P.O. BOX 26110
SANTA FE, NM 87502

**NOTICE OF A 30-DAY
PUBLIC COMMENT PERIOD
AND COMMUNITY
MEETING FOR DRAFT
TOTAL MAXIMUM DAILY
LOADS (TMDLs)**

THE NEW MEXICO ENVIRONMENT DEPARTMENT, SURFACE WATER QUALITY BUREAU ON THE PROPOSED TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR PONIL AND MIDDLE PONIL CREEKS

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A TMDL is a specific, water quality goal and a means for recommending controls needed to meet water quality standards in a particular water or watershed. Establishing a TMDL is an important step in watershed protection because it sets quantified goals for water quality conditions that may then determine what actions are needed to restore or protect the health of the waterbody. Ponil Creek (from the mouth on the Cimarron River to the confluence of North Ponil and South Ponil Creeks, 15.8 miles) has a sub-watershed size of 333 square miles and flows east of the town of Cimarron. Middle Ponil Creek (from the confluence with South Ponil Creek to the headwaters, 20.9 miles) flows through the Philmont Boy Scout Ranch with a sub-watershed size of 72 square miles.

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COUNTY OF SANTA FE

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/s/

mm Weideman
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this
9 day of April A.D., 2001

Notary

Laura L. Harling

Commission Expires

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Appendix E: Response to Comments

No comments were received.

References Cited

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